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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/927,265	08/10/2001	Thomas M. Barbara	01-04 US	5283

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Varian Inc.
Legal Department
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EXAMINER

VARGAS, DIXOMARA

ART UNIT PAPER NUMBER

2859

DATE MAILED: 09/10/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/927,265

Applicant(s)

BARBARA, THOMAS M.

Examiner

Dixomara Vargas

Art Unit

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-- Th MAILING DATE of this communication appears on th cov r sheet with th correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 May 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 3, 5 and 7-20 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 3, 5, 7, 8, 11, 12, 14, 15, 19 and 20 is/are rejected.
- 7) ☒ Claim(s) 9, 10, 13 and 16-18 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____
- 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 3, 7, 8, 11, 12, 14, 15 and 19-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mansfield et al. (US 4,978,920) in view of Hass et al. (US 5,729,141).

With respect to claim 1, Mansfield discloses an extended Maxwell pair comprising (Figures 19 and 25; Column 17, lines 25-26): a pair of semi-cylindrical gradient coils disposed coaxially around and along a z-axis extending in z-direction and symmetrically with respect to an origin (Figures 19 and 25), each being of radius a and of axial length d (Column 12, lines 18-32; Figures 19 and 25), said pair being mutually separated by a center-to-center distance Z_0 which is greater than d (Figures 19 and 25); and means for causing equal magnitude currents to flow through said gradient coils in mutually opposite directions (Figures 19 and 25; as shown by arrows); values of d and Z_0 being selected such that said equal currents generate a magnetic field along said z-axis with a linear gradient near said origin in said z-direction (Column 12, lines 27-29); a pair of shield coils disposed coaxially around said gradient coils, each of said shield coils being of radius b which is greater than a (Column 17, lines 30-34; Figure 25, #S1 and #S2), said means causing said equal magnitude currents to flow through said shield coils, said shield coils serving to cancel magnetic field outside said shield coils (Column 12, lines 29-32).

Mansfield discloses the claimed invention except for the shield coil pair being of equal radius and axially spaced. However, Hass discloses the shield coils of equal radius and axially spaced (Figure 17, wherein the gradient is #64 and the shield is #62). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Hass teachings for the shielding configuration with Mansfield's Maxwell pair for the purpose of increasing the space within the bore so as to attain open regions with a reduction of the interaction of the RF field with the gradient and reduce eddy currents produced in the conductors as shown by Hass (Column 2, lines 44-64).

3. With respect to claim 3, Mansfield discloses said magnetic field along said z-axis, when expanded in a polynomial form in z, does not include a cubic term (Column 12, lines 35-50).
4. With respect to claim 7, Mansfield discloses each of said shield coils comprises a wire which is wound cylindrically at specified intervals, said intervals being determined such that said shield coils have effects of canceling magnetic field external to said shield coils (Column 12, lines 29-32; Figure 25).
5. With respect to claims 8 and 19, Mansfield discloses a and d are of a same order of magnitude (Figures 19 and 25).
6. With respect to claim 11, see rejection of claims 1, 9 and 10 above.
7. With respect to claim 12, Mansfield discloses said shield coil current distribution by discrete conductor disposition on said cylindrical shield coil surfaces (Columns 17-18, lines 25-66 and 1-47 respectively; Figure 25).
8. With respect to claims 14 and 15, Mansfield discloses said linearity equation is solved numerically (Column 17, lines 30-45).

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9. With respect to claim 20, see rejection of claims 1, 9 and 10 above.

10. Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mansfield et al. (US 4,978,920) in view in view of Hass et al. (US 5,729,141) and in further view of Vavrek et al. (US 5,185,576).

With respect to claim 5, Mansfield and Hass disclose the claimed invention as stated above in paragraph 2 except for said gradient coils comprises a helically rolled rectangular conductor sheet. However, Vavrek discloses said helically rolled structure (Figures 2 and 3). Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to use Vavrek's teachings for the gradient coil configuration with Mansfield and Hass' Maxwell pair for the purpose of avoiding interaction between the gradient with any other RF coil and improving the SNR (Column 4, lines 3-17).

Allowable Subject Matter

11. Claims 9, 10, 13, 16-18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

12. The following is a statement of reasons for the indication of allowable subject matter:

With respect to claims 9 and 13, the prior art fails to teach or fairly suggest a Maxwell gradient pair with axially spaced shielding of opposing current coils wherein a, b, d and Z_0 satisfy an equation given by $\int_0^{k_{\max}} dk k^4 \{ \sin(kd/2) \sin(kZ_0/2) / (kd/2) \} \text{So}(k) K_0'(ka) I_0(k\rho) = 0$ where

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$S_0(k) = 1 - K_1(kb)I_1(ka)/K_1(ka)I_1(kb)$, and K_1 are modified Bessel functions, k_{\max} is an appropriately selected upper limit of integration and ρ is an appropriately selected value less than a .

13. With respect to claims 10 and 17, the prior art fails to teach or fairly suggest a Maxwell gradient pair with axially spaced shielding of opposing current coils wherein the gradient coils and the shield coils are structured such that the equal currents will have current distribution along said z-axis given by j and j respectively for said gradient coils and said shield coils, and an shielding equation given by $I^S(k) = -(a/b)(I_1(ka)/I_1(kb))I^P(k)$ is satisfied where I_1 , are modified Bessel functions of the first kind, $I_p(k)$ and $I_s(k)$ are current density functions $I_p(z)$ and $I_s(z)$ respectively for said gradient coils and said shield coils Fourier-transformed into k-space, $I_p(z) = \int_{-\infty}^z dz' j^P(\phi, z')$ and $I_s(z) = \int_{-\infty}^z dz' j^S(\phi, z')$.

14. With respect to claims 16 and 18, the claim has been found allowable due to its dependency on claims 13 and 17 above.

Conclusion

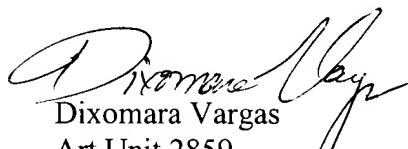
15. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. The additional prior art cited in the PTO 892 discloses Maxwell pair configurations with shielding coils surrounding the gradient coils.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dixomara Vargas whose telephone number is (703) 305-5705. The examiner can normally be reached on 8:00 am. to 4:30 pm..


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If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez can be reached on (703) 308-3875. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0956.



Dixomara Vargas
Art Unit 2859
September 1, 2003



Diego Gutierrez
Supervisory Patent Examiner
Technology Center 2800